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EFFECT OF COOKING METHOD ON FAT CONTENT AND PALATABILITY OF BEEF PATTIES

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I. INTRODUCTION

Ground beef is the most widely consumed beef product in North America due to its affordability, convenience and versatility [1]. However, consumer concerns over fat intake, particularly saturated fat from animal sources, have led to increased interest in leaner options and clearer nutritional information [2]. While raw ground beef labels provide composition details, the fat content of the final cooked product can vary significantly depending on cooking method and preparation. Previous research has shown inconsistent effects of methods like pan-frying, broiling or grilling on fat content and sensory quality, and many of these studies are now decades old. With recent shifts in beef production and the emergence of new techniques like air-frying, a re-evaluation is timely. The objective of this study was to assess how cooking method affects the fat content and palatability of Canadian ground beef with varying fat levels.

II. MATERIALS AND METHODS

Twelve packages of extra-lean (~10% fat), lean (~17% fat), and medium (~23% fat) ground beef were purchased from grocery stores in Alberta, Canada. From each package, eight 150 g patties were formed using a patty press and frozen at -20°C. The eight patties from the same package were cooked simultaneously from frozen to an internal temperature of 71°C, with two patties assigned to each cooking method (grilling, pan-frying, air-frying and broiling). The first patty was then cut into wedges, equilibrated to 68°C in a water bath and served to a 10-member trained meat evaluation panel for sensory evaluation; the second was ground and a 50 g was stored at -20°C for fat content analyses. The effect of cooking method on patty fat content and palatability was analyzed by ANOVA in the MIXED procedure of the Statistical Analysis Software (SAS, Version 9.4, SAS Institute Inc., Cary, NC), by each patty type.

III. RESULTS AND DISCUSSION

For regular and lean patties, the air-fried and broiled patties had less fat than the grilled patties ($P<0.05$), the regular air-fried patties less than the regular pan-fried patties ($P<0.05$), and the lean air-fried and broiled patties less fat than the lean-pan-fried patties ($P<0.01$) (Tables 1-2). Regular broiled patties also had less fattiness than pan-fried patties, less residual mouth coating than grilled and pan-fried patties, and less beef flavour intensity, flavour desirability and overall palatability than grilled patties ($P<0.05$, Table 1). Among lean patties, air-frying and broiling produced less fattiness and residual mouth coating than grilling and pan-frying, and less overall tenderness, beef flavour intensity, flavour desirability and overall palatability compared to grilling ($P<0.01$, Table 2). Lean broiled patties also had less overall tenderness, beef flavour intensity, flavour desirability and overall palatability than pan-fried patties ($P<0.01$, Table 2). In the extra-lean patties there were no significant differences in fat content among the cooking methods ($P>0.1$, Table 3). Air-frying and broiling produced less fattiness than pan-frying ($P<0.001$, Table 3) and less residual mouth coating, beef flavour intensity, flavour desirability and overall palatability than grilling and pan-frying ($P<0.001$, Table 3). Extra-lean air-fried patties also had less fattiness than grilled patties ($P<0.001$, Table 3) and were less tender than grilled and pan-fried patties ($P<0.001$, Table 3). Finally, air-fried and broiled patties of all fat levels were less juicy than corresponding grilled and pan-fried patties ($P<0.01$, Tables 1-3).

IV. CONCLUSION

Overall, grilling and pan-frying were the cooking methods that reduced fat content the least, but provided a better eating experience. Broiling and air-frying resulted in greater reduction of fat content, especially in regular and lean patties, but led to poorer palatability scores (broiling in regular and lean patties and air-frying in extra lean beef).

Table 1. Effect of cooking method on regular patty fat content and palatability.

	Air-fried	Broiled	Grilled	Pan-fried	SEM	*P*-value
Fat (%, DMB)	42.6^{c}	43.6^{bc}	45.9^{a}	44.9^{ab}	0.72	**<0.05**
Initial tenderness	7.02	6.75	6.89	6.96	0.14	0.428
Initial juiciness	6.09^{b}	5.94^{b}	6.80^{a}	6.88^{a}	0.16	**<0.001**
Beef flavour desirability	6.88^{b}	6.39^{c}	7.23^{a}	6.98^{ab}	0.14	**<0.001**
Beef flavour intensity	6.63^{bc}	6.37^{c}	7.17^{a}	6.85^{b}	0.15	**<0.001**
Off-flavour intensity	8.66	8.60	8.72	8.70	0.14	0.897
Overall tenderness	7.00	6.79	7.04	7.08	0.15	0.312
Sustainable juiciness	6.34^{b}	6.04^{b}	6.79^{a}	6.81^{a}	0.14	**<0.001**
Fattiness	6.92^{ab}	7.01^{a}	6.62^{ab}	6.54^{b}	0.21	**<0.05**
Residual mouth coating	6.94^{ab}	7.07^{a}	6.62^{b}	6.63^{b}	0.20	**<0.05**
Overall palatability	6.70^{ab}	6.43^{b}	7.03^{a}	6.76^{ab}	0.16	**<0.05**

Table 2. Effect of cooking method on lean patty fat content and palatability.

	Air-fried	Broiled	Grilled	Pan-fried	SEM	*P*-value
Fat (%, DMB)	38.1^{b}	38.3^{b}	41.5^{a}	41.5^{a}	0.90	**<0.001**
Initial tenderness	6.62	6.60	6.87	6.82	0.24	0.342
Initial juiciness	5.97^{b}	5.64^{b}	6.59^{a}	6.52^{a}	0.24	**<0.001**
Beef flavour desirability	6.57^{bc}	6.38^{c}	7.13^{a}	6.89^{ab}	0.24	**<0.01**
Beef flavour intensity	6.47^{bc}	6.32^{c}	6.95^{a}	6.81^{ab}	0.21	**<0.001**
Off-flavour intensity	8.77	8.75	8.61	8.59	0.17	0.658
Overall tenderness	6.74^{bc}	6.54^{c}	7.14^{a}	6.94^{ab}	0.24	**<0.01**
Sustainable juiciness	6.09^{b}	5.84^{b}	6.65^{a}	6.49^{a}	0.23	**<0.001**
Fattiness	8.03^{a}	7.96^{a}	7.64^{b}	7.70^{b}	0.15	**<0.01**
Residual mouth coating	7.89^{a}	7.88^{a}	7.57^{b}	7.65^{b}	0.13	**<0.01**
Overall palatability	6.60^{bc}	6.29^{c}	7.12^{a}	6.70^{b}	0.27	**<0.001**

Table 3. Effect of cooking method on extra-lean patty fat content and palatability.

	Air-fried	Broiled	Grilled	Pan-fried	SEM	*P*-value
Fat (%, DMB)	27.8	28.6	28.8	29.5	1.34	0.183
Initial tenderness	5.43^{b}	5.89^{ab}	6.22^{a}	6.32^{a}	0.36	**<0.001**
Initial juiciness	4.91^{b}	5.03^{b}	6.06^{a}	6.28^{a}	0.34	**<0.001**
Beef flavour desirability	6.21^{b}	6.21^{b}	6.95^{a}	6.63^{a}	0.32	**<0.001**
Beef flavour intensity	5.99^{c}	6.01^{c}	6.88a	6.43^{b}	0.31	**<0.001**
Off-flavour intensity	8.54	8.72	8.91	8.60	0.16	0.344
Overall tenderness	5.76^{c}	6.08^{bc}	6.57^{a}	6.49^{ab}	0.34	**<0.001**
Sustainable juiciness	5.23^{b}	5.35^{b}	6.13^{a}	6.16^{a}	0.32	**<0.001**
Fattiness	8.41^{a}	8.31^{ab}	8.09^{bc}	8.02^{c}	0.13	**<0.001**
Residual mouth coating	8.33^{a}	8.10^{a}	7.87^{b}	7.82^{b}	0.12	**<0.001**
Overall palatability	5.52^{b}	5.81^{b}	6.75^{a}	6.27^{a}	0.30	**<0.001**

DMB, dry matter basis. SEM, standard error of least squares means. Different superscripts indicate significant differences (P<0.05). Descriptive sensory scales: 9 = extremely tender, extremely juicy, extremely desirable flavour, extremely intense beef flavour, extremely bland off-flavour, no fattiness, no residual mouth coating, and extremely desirable overall palatability; 1 = extremely tough, extremely dry, extremely undesirable flavour, extremely bland beef flavour, extremely intense off-flavour, extremely abundant fattiness, extremely abundant residual mouth coating, and extremely undesirable overall palatability.

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